**Hypothesis Testing Exercise Solution**

1. A F&B manager wants to determine whether there is any significant difference in the diameter of the cutlet between two units. A randomly selected sample of cutlets was collected from both units and measured? Analyze the data and draw inferences at 5% significance level. Please state the assumptions and tests that you carried out to check validity of the assumptions.

Minitab File : Cutlets.mtw

Answer : python file name : Q1\_Ans\_cutlets.py

Business Objective : Two check whether the diameter of two units are similar

or not?

Ho : Diameter of two Units are not similar

Ha : Daimeter of two Units are similar

Step 1 : Data output is continuous and we are comparing two groups.

So here is y is continuous and x is discrete.

Step 2 : To check Normal Distribution

Ho : Data is following normal distribution

Ha : Data is not following normal distribution

For UnitA : (0.9649458527565002,p-value 0.3199819028377533)

For UnitB : (0.9727300405502319,p-value 0.5224985480308533)

p-value > 0.05 => p high Ho fly => fail to reject Ho => Data is normally distributed

Step 3 : To check Variance

Ho: variance of unitA = variance of unitB

Ha: variance of unitA NOT= variance of unitB

p-value=0.4176162212502553

p-value > 0.05 => p high Ho fly => fail to reject Ho => Variance are Equal

Step 4 : choose the Test

* 2 sample T test for equal variance
* Ho: variance of unitA = variance of unit B
* Ha: variance of unitA NOT = variance of unitB

p-value = 0.23611973622997873

p-value > 0.05 => p high Ho fly => Accept Ho

hence Average of unit A = Average of unit B

Conclusion :

As per above results we can say that there is similarity between unitA and unitB i.e unitA = unitB

2) A hospital wants to determine whether there is any difference in the average Turn Around Time (TAT) of reports of the laboratories on their preferred list. They collected a random sample and recorded TAT for reports of 4 laboratories. TAT is defined as sample collected to report dispatch.

Analyze the data and determine whether there is any difference in average TAT among the different laboratories at 5% significance level.

Minitab File: **LabTAT.mtw**

Answer : : python file name : Q2\_Ans\_LabTAT.py

Business Objective : Two check whether there is any difference in average TAT

Ho : NOT any difference in average TAT

Ha : difference in average TAT

Step 1 : Data output is continuous and we are comparing four groups.

So here is y is continuous and x is discrete.

Step 2 : To check Normal Distribution

Ho : Data is following normal distribution

Ha : Data is not following normal distribution

if p-value is > 0.05 => Accept null hypothesis

if p-value is < 0.05 =>Reject null hypothesis

alternate hypothesis is used when we take action or p-value is less than 0.05

For laboratory1 : (0.9901824593544006, p-value 0.5506953597068787)

For laboratory2 : (0.9936322569847107,p-value 0.8637524843215942)

For laboratory3 : (0.9886345267295837,p-value 0.4205053448677063)

For laboratory4 : (0.9913753271102905,p-value 0.6618951559066772)

p-value > 0.05 => p high Ho fly => Accept Ho => Data is normally distributed

hence accept null hypothesis Ho

Step 3 : To check Variance

Ho: All variance are equal

Ha: Atleast one variance is different

p-value = 0.05161343808309816

p-value > 0.05 => p high Ho fly => Accept Ho => Variance are Equal

hence we prove variance of all laboratory are same

Step 4 : choose the Test

* One Way ANOVA Test
* Ho: Average of all laboratory are same
* Ha: Average of atleast 1 laboratory are different

p-value = 0.00

p-value < 0.05 => Accept Ha alternate hypothesis

hence Average of atleast 1 laboratory are different

Conclusion :

As per results we can say that these are not equal i.e Average of atleast 1 laboratory are different.

1. Sales of products in four different regions is tabulated for males and females. Find if male-female buyer rations are similar across regions.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **East** | **West** | **North** | **South** |
| Males | 50 | 142 | 131 | 70 |
| Females | 550 | 351 | 480 | 350 |

Answer :

Step1 : Business Objective :

Two find buyer ratios are similar across region or not

Step 2: y and x

x is more than 2 discrete and y is discrete

Step 3: Here we will use Chi-square test

null hypothesis(ho): Data are normal

alternate hypothesis(ha): data are not normal

if p-value is > 0.05 => Accept null hypothesis

if p-value is < 0.05 =>Reject null hypothesis

Step 3: Here we will use Chi-square test

Chi-Square Test

Ho: All averages are same

Ha : atleast 1 are different

P-value is 0.297 > 0.05=>P high Ho fly => Accept Ho, hence Average are same

Conclusion :

As per results we can say that there is proportion of male and female buying is similar

Q.4) TeleCall uses 4 centers around the globe to process customer order forms. They audit a certain % of the customer order forms. Any error in order form renders it defective and has to be reworked before processing. The manager wants to check whether the defective % varies by centre. Please analyze the data at *5%* significance level and help the manager draw appropriate inferences

Minitab File: **CustomerOrderForm.mtw**

Answer:

Step1: Business Objective

To check whether the defective % varies by center or not

Step2 : y and x

x is more than 2 discrete and y is discrete

Step3 : Here we will use Chi-square test

Chi-Square Test

H0:All are same

Ha: atleast 1 are different

P-value is 0.2271 > 0.05=>P high Ho fly => Accept Ho, hence Average are same

As per results we can say that all the canters are equal.

Q. 5 ) Fantaloons Sales managers commented that *%* of males versus females walking in to the store differ based on day of the week. Analyze the data and determine whether there is evidence at *5 %* significance level to support this hypothesis.

Minitab File: **Fantaloons.mtw**

Answer :

Step1: Business Objective

To find proportion male vs female differ from weekdays or weekends are equal or not

Step2: y and x

x is discrete with 2 categories and y is discrete

Step3 : Here we will use 2-Proportion test

2-Proprotion Test

Ho: Proportion of male vs female in weekdays = Proportion of male vs female in weekends

Ha: Proportion of male vs female in weekdays NOT = Proportion of male vs female in weekends

P-value is 0.9681 > 0.05=>P high Ho fly => Accept Ho

Conclusion :

Hence Proportion of male vs female in weekdays = Proportion of male vs female in weekends